



PRESIDENT'S MALARIA INITIATIVE



National IRS Strategy for Liberia

2012 - 2017

Integrated Vector Management (IVM) Task Order 2

Contract GHA-I-02-04-00007-00

Prepared for:

United States Agency for International Development

Prepared by:

RTI International

3040 Cornwallis Road

Post Office Box 12194

Research Triangle Park, NC 27709-2194

RTI International is dedicated to conducting research and development that improves the human condition by turning knowledge into practice. With a staff of more than 2,500, RTI offers innovative research and technical solutions to governments and businesses worldwide in the areas of health and pharmaceuticals, education and training, surveys and statistics, democratic governance, economic and social development, advanced technology, energy, and the environment. The second largest independent nonprofit research organization in the United States, RTI maintains nine offices in the U.S., five international offices, and one international subsidiary, as well as project offices around the world.

RTI International is a trade name of Research Triangle Institute.

August 2012

This report was produced for review by the United States Agency for International Development. It was prepared by RTI International. The author's views expressed in this report do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

Republic of Liberia

Ministry of Health and Social Welfare



National IRS Strategy

2012 - 2017

Content

Terminology	iv
Forward	v
1. BACKGROUND	1
2. OBJECTIVES OF NATIONAL IRS IMPLEMENTATION	3
Strategic Objective for IRS:	3
Specific Objectives for IRS:	3
3. IMPLEMENTING IRS IN THE CONTEXT OF INTEGRATED VECTOR MANAGEMENT	4
3.1. Legislation, regulation and general management of public health insecticides	4
<i>Taxes and Tariff adjustment to promote IRS</i>	8
3.2. Advocacy and Social Mobilization	9
3.3. Cross Sector Collaboration	10
3.4. Capacity Strengthening	13
3.4a Human Resources	13
3.4b Information management for IRS	15
3.5 Evidence-Based Decisions Making	17
3.5a Entomology Monitoring	18
3.5b Epidemiological Monitoring	21
3.5c Operational and outcome indicators	21
3.5d Insecticide Selection for IRS	22
3.5e Management of Vector Resistance to IRS Insecticides	23
4. SELECTION OF IRS TARGET AREAS	26
4.1 Timing of IRS in Liberia	28
5. REFINEMENT OF IRS AND INTEGRATION WITH LLIN DEPLOYMENT	28
6. WASTE MANAGEMENT	30
7. RESOURCE MOBILIZATION	31
ANNEX 1: MAJOR FOLLOW UP ACTIVITIES	33
ANNEX 2: ENVIRONMENTAL & HUMAN HEALTH SAFEGUARDS IN IRS	34

Terminology

AIDS	acquired immunodeficiency syndrome
CAMA	Corporate Alliance for Malaria in Africa
CDC	US Centers for Disease Control
ELISA	Enzyme-linked immunosorbent assay
FAO	The Food and Agriculture Organization of the United Nations
GFATM	Global Fund for HIV/AIDs, TB and Malaria
IVM	Integrated Vector management
IRS	Indoor Residual Spraying
LIBR	Liberia Institute for Biomedical Research
LLIN	Long lasting insecticide treated nets
MOH&SW	Ministry of Health and Social Welfare
NGO	Non-Governmental Organization
NMCP	National Malaria Control Program
PCR	Polymerase chain reaction
PMI	US President Malaria Initiative
RBM	Roll Back Malaria
RTI	Research Triangle Institute
VBD	Vector Borne Diseases
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Schemes

Forward

Consistent with the recommendations of the World Health Organization, Liberia has adopted an integrated vector management (IVM) approach, as part of its national malaria control strategy. The 2010-2015 National Malaria Control Strategy anticipates a rapid scale up in the use of both indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) to cover all populations at risk. For IRS the goal is to scale up to 50% coverage of the total national population.

A national IRS strategy for Liberia is herein proposed. The context is to implement the IRS strategy within an overarching IVM strategy, consistent with current recommendations of the World Health Organization. This national IRS strategy outlines priority areas and provides general guidance to the subsequent development of a comprehensive national IRS work plan that will envisage and adequately address all aspects of planning, management, implementation, and monitoring and evaluation to facilitate national scale up IRS operations. The elaboration of a comprehensive national IRS work plan will:

- (i) Enable enhanced mobilization of national action towards cost-effective and sustainable IRS implementation that adequately considers the role of other complimentary interventions in operational and management settings that are best suited to the local malaria eco-epidemiology in Liberia.
- (ii) Focus national efforts at ongoing generation of relevant local data to enable informed and science-based decisions, including the geographical deployment of IRS; selection of insecticides; and ongoing refinement of IRS deployment within the context of an integrated approach to the management of local malaria vectors.
- (iii) Properly contextualize and therefore streamline informed collaboration and support by Liberia's developmental partners in national malaria control efforts.
- (iv) Facilitate a more aggressive and sustainable resource mobilization by providing a sound basis for forward planning by government on the allocation of national resources, as well as structured submissions to the Global Fund and other such external funding sources.

1. BACKGROUND

Malaria is prevalent throughout Liberia with the entire population at risk. Generally, malaria prevalence is higher among rural communities; parasite rates in children under five years are 38% in rural children and 21% in urban children of the same age. The average national prevalence is 32%¹. More than 90% of malaria cases are caused by *Plasmodium falciparum* (>90%)², which is the most deadly species of malaria parasite. The 2009 Health Facility Survey indicated approximately 6.6 million episodes of malaria across all age groups. The survey also showed malaria as responsible for 34.6% of outpatient visits and 33% of in-patient deaths. While this is a marked reduction from the 2005 Malaria Health Survey findings of 37.5% and 44.3%, respectively, malaria is still a large public health problem and causes an economic burden on Liberia as a whole.

Indoor residual spraying (IRS) was first piloted in the 1950s - linked with the first clustered trials to evaluate the feasibility of eradicating malaria in Africa. The country was the site for the first large-scale use of synthetic insecticide to combat malaria in tropical Africa, and the WHO pilot project in Central Province was one of a first cluster of projects initiated to explore the efficacy of IRS in a variety of African ecological zones. IRS was reintroduced in Liberia in 2007 and 2008 in camps for internally displaced persons to protect approximately 150,000 people. A formal IRS campaign began in 2009 under the President's Malaria Initiative (PMI). From an initial coverage of 22,000 houses in three districts, the program expanded in 2010 to cover 8 districts in three counties and a population of about 420,532 people (12% of country's population), including 16.4% children under 5 years and 5.3% pregnant women. Coverage increased further to 80,000 houses in 2011, protecting 500,000 persons. The 2010-2015 National Malaria Strategic Plan indicates the objective of increasing the use of IRS in rural areas and to cover approximately 50% of the entire population, covering 85% of households in the target areas.

¹ 2009 Liberia Malaria Indicator Survey

² 2001 Roll Back Malaria - National Desk Analysis

Liberia achieved a national universal distribution target of providing 1 LLIN for each sleeping place or three LLINs per family³ in the first half of 2012. LLIN distribution has been supported by the Global Fund for HIV/AIDS, TB and Malaria (GFATM), US President Malaria Initiative (PMI), United Nations Children's Fund (UNICEF) and other NGOs. While the national distribution target for LLIN has been achieved, there is a need to enhance strategies to improve utilization rate and LLIN replacement. A 5 year national LLIN strategy is being developed by the NMCP for 2012-2017, to provide a robust framework to national efforts.

Effective malaria control in Liberia will require that:

- (i) Appropriate human, infrastructure and managerial capacities are developed at all levels of program administration (national, regions and counties). This is critical to ensure that the required local data on disease transmission is generated to inform decision making on the deployment of intervention and adequate evaluation of program outcome and impacts. Such capacities are also critical for ongoing refinement of national action to improve overall efficiency and impact on disease burdens. Secondly, a major threat to insecticide- based intervention is the development of insecticide resistance in local mosquito vectors. Relevant technical competences in entomology are important to better manage this threat and ensure the continued utility of IRS.
- (ii) To be sustainable, the deployed interventions must be cost-effective and progressively more efficient, as limited resources are applied to reduce the gap in population coverage.
- (iii) An appropriate regulatory environment is established to ensure effective control of insecticides. Effective pesticide management will assure product quality and adequate human and environmental safeguards in the handling, judicious use and disposal of public health insecticides.

³ The average household size in Liberia is estimated at 5 persons.

2. OBJECTIVES OF NATIONAL IRS IMPLEMENTATION

Strategic Objective for IRS:

The 2010 – 2015 National Malaria Strategic Plan for Liberia indicates a two-fold strategic objective aimed to increase coverage of IRS to 50% of the entire national population. Namely:

- a) To quickly reduce transmission intensity and suppress seasonal peaks, thereby reducing overall transmission, and
- b) To complement the use of LLINs to reduce malaria prevalence, morbidity and mortality.

The strategy recognizes the use of IRS within the context of integrated vector management and sustainable gains.

Specific Objectives for IRS:

To achieve the above strategic objectives, three specific objectives are envisaged and drive the elaboration of the current strategy:

- (i) *To deploy well-targeted, cost-effective and sustainable indoor residual spraying based on sound local evidence on disease eco-epidemiology and operational feasibility* - With the achievement of the national target for LLINs distribution in 2012, under the universal coverage policy, as well as ongoing efforts to further improve on LLIN utilization rate, emphasis will be on deploying IRS in areas of highest malaria transmission, to facilitate quick suppression of transmission and force lower transmission equilibrium. This will create prospects for further reductions, as the utilization of LLIN increases (ref: Chapter 5).
- (ii) *Establish a robust scheme to manage the development of insecticide resistance among the local malaria vectors, to ensure the continued utility of the WHOPES approved insecticides*
- (iii) *Develop relevant human, technical and infrastructure capacities for IRS* - Efforts will be informed by clarified overall national needs for IVM implementation, include range and placement/distribution of technical capacities and trained human resources.

3. IMPLEMENTING IRS IN THE CONTEXT OF INTEGRATED VECTOR MANAGEMENT

IRS scale up in Liberia will be within the context of an overarching national strategy on Integrated Vector Management (IVM). Defined as “*a rational decision-making process for the optimal use of resources for vector control,*”⁴ the World Health Organization recommends IVM as the preferred approach for the ecologically sound, cost-effective and sustainable control of the vectors of human diseases such as malaria. IVM provides a robust framework for the systematic development of a national IRS strategy and the organization of implementation activities. The areas of IRS alignment with the five elements of the IVM framework are listed in Table 1 and elaborated in succeeding sections.

Liberia has initiated vigorous efforts to transition to IVM as a national strategic approach for malaria control. As part of the process, a vector control needs assessment (VCNA) was initiated in May 2011. The VCNA process is also recommended as a first step in national transition as it enables a review of the current framework and status of vector control - identifying existing constraints to achieving set objectives, in addition to opportunities and requirements for resolving the constraints, and increase implementation efficiencies and impact on local disease burdens.

3.1. Legislation, regulation and general management of public health insecticides

Effective management of public health insecticides is a basic requirement for deploying any insecticide based intervention. Public health insecticides must be fully regulated to ensure that human health and the environment are adequately protected. Hence, the scale up of IRS in

⁴ WHO (2010). *WHO Position Statement on Integrated Vector Management*. World Health Organization, Geneva Switzerland. *WHO/HTM/NTD/NEM/2008.2*

Table 1: Application of IVM Elements to the organization of IRS

IVM Element	Summary of Scope	Specific Application to IRS Operations
Legislation	<ul style="list-style-type: none"> • Regulatory and legislative controls for public health and pesticide management well established, reviewed, kept current and relevant 	<ul style="list-style-type: none"> • Assure adequate, up to date national insecticide legislation & regulatory mechanisms to facilitate judicious use & safeguard human health & environment • Establish appropriate taxes and tariffs regimes to promote IRS
Advocacy/social mobilization	<ul style="list-style-type: none"> • IVM principles embedded in development policies of all relevant agencies, organizations & civil society 	<ul style="list-style-type: none"> • Advocacy/communication on IRS targeting policy makers, implementers, communities and other stakeholders including donors to foster favorable policy environment
Cross sector collaboration	<ul style="list-style-type: none"> • Functional collaboration between public & private sectors • Effective channels of communication among policymakers, VBD control programs and partners 	<ul style="list-style-type: none"> • Establish fully mandated national and subnational mechanisms for consultations, joint planning and implementation by stakeholders, with clearly defined roles/responsibilities
Capacity building	<ul style="list-style-type: none"> • Essential physical infrastructure, financial resources and adequate human resources developed at all levels to manage local vectors 	<ul style="list-style-type: none"> • Identify range of skills/competencies, staffing levels and location for effective IRS operations • Establish trained human resources (spray operators, pesticide warehouse managers, entomology and epidemiology capacities, vector control, environmental safety/compliance etc); mobilize relevant cross sectoral capacities • Establish requisite infrastructure for IRS (insectaries, entomology labs, insecticide warehouses, waste disposal systems etc) • Establish & integrated vector control information system with national disease/malaria info system
Evidence-based decision making	<ul style="list-style-type: none"> • Strategies and interventions adapted to local ecology, epidemiology and resources, guided by routine monitoring and evaluation and operational research and 	<ul style="list-style-type: none"> • Clarify information needs, indicators and data collection methods • Establish entomological and epidemiological monitoring plans for targeting, M&E • Select insecticide based on local knowledge on vector susceptibility/resistance • Assure timeliness and completeness of data; manage and utilize evidence for decisions on IRS implementation and strategy refinement
Integrated approaches	<ul style="list-style-type: none"> • Rational utilization of resources, including appropriate integration of vector tools, methods & multi- disease control approaches. 	<ul style="list-style-type: none"> • Clarify/justify IRS target areas within a national IVM context, utilizing generated local evidence • Assure adequate and evidence-based guidance on combinations with LLINs, short-term impact and long-term disease control objective

Liberia will be preceded by a comprehensive assessment of the adequacy of existing national legislation and regulations covering the use of public health insecticides in general and particularly those relevant to IRS. Gaps and weaknesses that are identified by the assessment will be remedied as part of national preparations for scaled up interventions. Procedures for registering, licensing and importation of WHOPEs approved insecticides for IRS will be further streamlined to ensure that approved vendors are equipped to transmit all appropriate information on the handling, use and disposal of the insecticide. This will also ensure that the country is well positioned to facilitate the consideration of new insecticides that are approved by the WHO Pesticide Evaluation Scheme (WHOPEs) – especially noting the preexisting foci of insecticide tolerance/resistance in the malaria vector populations within the West Africa region.

To comply with the enhanced national regulations on pesticides, as well as relevant recommendations of the WHO and FAO (e.g. *International Code of Conduct on the Distribution and Use of Pesticides*), a risk assessment detailing potential risks to human health and the environment in the use and national scale up of IRS, will be comprehensively assessed. The risk assessment will detail the potential risks within the many riverine ecological zones in Liberia which may be targeted for IRS, rationale for the selection of any insecticide for IRS which may (including adequate consideration of impact on any preexisting tolerance/resistance in the local vector populations), potential risks in the handling and judicious use of the IRS insecticides. This will lead to the establishment of safeguards which will form the basis of compliance inspections of IRS operations. Systems for national enforcement of pesticide regulations and the established safeguards will be enhanced. It will include the creation of appropriate educational, advisory, extension and health-care services. Anticipated human health and environmental safeguards will include the following considerations:

- a. Regular review, updating and harmonization of relevant pesticide management laws, regulations and institutional arrangements, to assure ongoing and adequate protection of human health and the environment in IRS operations. Appropriate procedures should be established to ensure effective communication between enforcement agencies such as police and the environmental protection agency on one hand, and the IRS program implementers. Penalties for breaking laws regulating the use of insecticides will be clarified

and broadcasted, and access to IRS insecticides will be restricted to authorized persons/outfits.⁵

- b. Selected insecticides for IRS will be procured from internationally recognized/ certified manufacturers and/or their certified and authorized local agents; procurement procedures will be transparent and fully compliant with national procurement regulations. There will be verifiable import shipment and chain of custody within country, and country capacity for assuring the quality of the quality of procured insecticides will be enhanced, with a medium to long term goal of establishing full local capacity for testing or validating active ingredient and formulation.
- c. WHOPES approved insecticides will be used for IRS in Liberia under the provision of full compliance with recommended formulations and product quality
- d. All categories of insecticide handlers, particularly spray operators and drivers, will be trained and certified on best practices in accordance with national regulations and recommendations of WHO and FAO in the handling. These will cover the whole insecticide life cycle – including storage, transportation, end-use and disposal. It will be a national requirement to certify all spray operators, in which certification will be based on completing stipulated training or undertaking stipulated periodic refresher training.
- e. Warehousing capacity will be established in the targeted districts for the IRS-related supplies and equipment to facilitate logistics management. Harmonized pesticide storage and inventory practices will be established informed by national regulations and relevant recommendations of WHO and FAO. A certification scheme will be established for all insecticide application equipment.

⁵ This would ideally be part of the responsibilities of a properly mandated and strengthened National Malaria Steering Committee that will also serve as the platform for coordinating inter-sectoral action on IVM (ref. Section 2c and Box 1)

- f. Strict use of personal protective equipment by all IRS workers who directly handle IRS insecticides – including spray operators, warehouse keepers, disposal personnel, washers/cleaning staff, transporters.
- g. Use of standardized procedures and practices, such as rinse water recycling to minimize effluent; the use of soak pits or concrete evaporation tanks depending on the insecticide selected – ensuring compliance with relevant recommendations on such as non-proximity of pits to river or underground water, and restricted access; environmentally sound disposal procedures for insecticide contaminated waste and packaging.
- h. Stringent procedures will be outlined to enforce compliance of safeguards outlined from risk assessment processes as previously described. Preparations will include the use of trained environmental compliance inspectors to monitor IRS field operations. Mechanisms will be established to ensure timely feedback of observations/conclusions from compliance inspections to the IRS program to facilitate ongoing enhancement of practices.
- i. Health facilities will be selected in the target geographic areas and equipped to serve as reference points for insecticide poisoning and training of relevant health workers to manage incidences of poisoning.

Taxes and Tariff adjustment to promote IRS

The Abuja Declaration of April 25, 2000, by African heads of state, advocated the elimination of taxes and tariffs on anti-malaria commodities to enable sustainable disease control. As necessary, the Government of Liberia will review the opportunities to work towards meeting this declaration with regards to the importation of insecticides, IRS pumps and personal protection equipment, as has been done for LLINs, to promote rapid scale up of IRS operations. This will be especially in relation to public sector and non-profit making initiatives.

3.2. Advocacy and Social Mobilization

Current IRS operations provide adequate lessons which will inform a well-designed and executed advocacy and communication strategy linked to the scale up of IRS implementation. Leadership will be provided by the NMCP to coordinate advocacy and communication with advice/input from communication outfits within the MOH and other sectors (e.g. EPA), as necessary. The long term viability of IRS is linked to the creation and sustenance of an enabling policy environment and the empowerment of targeted communities to proactively engage in IRS efforts and make positive choices on acceptance and household compliance. Targets for IRS advocacy and mobilization will therefore include:

- Policy makers: IRS operations require recurrent annual budget allocation. Therefore, a primary objective of advocacy and communication efforts to this group will aim to solicit buy-in and support for the intervention. Communication will be succinct and well-tailored and will cover the role and benefits of IRS in malaria control in Liberia. It will contextualize potential risks and clarify established safeguards to address any disquiets; clarify funding requirement to provide a basis for forward planning and in-country resource allocation; and summarize experiences and lessons from implementation that have direct policy implications.
- Donors and developmental partners: Advocacy and communication to this group aim at relaying the national strategy and goals for malaria control and the role of IRS (envisaged as integral part of an overarching IVM strategy) towards achieving the goals; targeted population to be protected through IRS, and the consequential and anticipated health and socio-economic impacts; implementation experiences and fund mobilization and gaps. The target may be within as well as external to the country. Such information is critical for donor decisions on funding and thus, important to the country's efforts to diversify and expand the funding sources for IRS.
- IRS target communities and general public: Advocacy and communication to this group will aim at promoting buy-in and maximizing acceptance rates, and will usually be timed to lead into and synchronize with field operations. Communication will focus on informing the

general public about the purpose and conduct of IRS intervention; explain the anticipated role of household occupants, including actions to reduce exposure, and clarify misconceptions. Advocacy and communication will be through various public news media, public fora with communities, as well as visits of trained IEC/BCC communicators to individual households prior to and during IRS spray rounds. As appropriate, communication should also be in local dialects to facilitate understanding among targeted communities.

- Technical staff: At the central, regions and county levels of program administration: the character and content of information will depend on the objective of the message and whether it is intended to mobilize the technical staff to undertake any of the advocacy/communication aforementioned. In addition, level-appropriate technical information will also be communicated directly to and from the various levels to support decision making at the various program administration levels.
- Other stakeholders (public and private sectors): Advocacy/communication to this target group will be aimed at clarifying the IRS intervention, along with its place and role in malaria vector control. It will also aim at soliciting stakeholder participation. For the private sector, an additional possible goal will be to either solicit direct contribution to the national program (financial, technical, supplies) or the initiation of private sector driven IRS operations as part of “corporate social responsibility” efforts, to protect staff or nearby/catchment townships.

3.3. Cross Sector Collaboration

Inter-sectoral collaboration is essential to the successful management of local malaria vectors. Since 2008 the IRS Task Force has been working to strengthen partnerships and coordination among national stakeholders on malaria control. The Task Force is led by the assistant Minister of Preventive Services, with the NMCP as the Secretariat. The Task Force advises and guides the NMCP and other participating partners on the content and organization of their

malaria work plan and projects. The Task Force will be a sub-Committee of the national IVM Steering Committee⁶. will be further strengthened and properly mandated to better facilitate and coordinate stakeholder action. Sectoral/stakeholder functions and roles will be clarified to foster transparency and accountability in collaboration. A potential mandate of the National Steering Committee is outlined in Box 1. Collaboration between NMCP and the following are considered particularly vital for IRS operation:

- *Ministry of Agriculture*: Collaboration will aim at facilitating the harmonization of regulatory mechanisms for insecticides, particularly those with shared use in agriculture and public health. The extension service infrastructure of the Ministry of Agriculture has been proven, in many countries, to be an excellent vehicle to promote judicious use of insecticides among farming communities – a critical point in any insecticide resistance management effort.
- *Environmental Protection Agency (EPA) and the Division of Environment and Occupational Health in MOH&SW*: Collaboration will aim at promoting robust environmental safeguards in the handling, storage, use and disposal of IRS insecticides. Together with the Division of Environment and Occupational Health in MOH&SW, which is mandated to ensure human health protection in insecticide usage, the EPA will play a very important role in compliance inspection of IRS field operations.
- *The Ministry of Internal Affairs (Local Government)*: Collaboration is critical to mobilizing targeted communities in IRS operations
- *Private Sector*: Malaria is a major threat to private sector profitability because it potentially raises the cost of labor through disease-related absenteeism and reduced worker output. Private sector investment in workplace and community-based programs in malaria prevention programs could reverse the adverse impact on business operations. On the other hand, the private sector brings critical business management competencies that could

⁶ Under the National IVM Strategy, the IVM Steering Committee, an inter0sectoral body, will coordinate national IVM endeavours.

contribute to the overall efficiency of public sector driven IRS operations. Coordination with the private sector also ensures that sector becomes abreast with policies and malaria vector control safeguards in natural resource development (e.g. agriculture, mining, water resource development). As a policy, the government will prioritize mobilization and active participation of the private sector in corporate social responsibility and work place malaria control endeavors. The NMCP has already developed excellent partnership with a number of partners in the agriculture and mining sectors in LLIN distribution and limited IRS operations. Opportunities for public-private-partnerships (PPP) will be fully explored and encouraged, and companies will be encouraged and facilitated to establish, IRS operations to cover staff, where appropriate - such efforts will be most desirable within the agribusiness and extraction sectors that usually involve mass worker settlement or clustered contracted private farmer groupings.

- *Non-Governmental Organizations (NGOs)*: Non-governmental organizations in Liberia play an important role in malaria control. Given the long standing established link with the communities, the NGOs can be mobilized to play important roles in behavior communication change efforts, as well as general community mobilization for IRS.
- *Research Institutes*: Research outfits, such as the Liberia Institute of Biomedical Research (LIBR), will provide critical support to the NMCP in entomological and epidemiological surveillance and monitoring under formal Memorandum of Understanding (MoU) between NMCP and LIBR. Modalities will be established to ensure that the excellent capacities of relevant national research outfits are harnessed to assist routine monitoring and operational research priorities in IRS and overarching national IVM efforts.
- *Developmental Partner Organizations*: Organizations such as WHO, UNICEF, Global Fund, and PMI/USAID are already actively partnering with the Government of Liberia on malaria control, PMI particularly on IRS implementation. These partnerships will be enhanced to ensure that collaboration and support fit more closely with national IRS and IVM strategies and work plans.

There is a much broader range of potential partners and stakeholders, for which efforts will be made to encourage their participation and input to national IRS efforts. As needed, the IRS Task Force will organize meetings and consultations to solicit inputs on specific issues.

3.4. Capacity Strengthening

3.4a Human Resources

Consistent with WHO recommendations, Liberia is undergoing national orientation towards an IVM approach to more effectively control the local vectors of malaria. The 2012-2007 National IVM Strategy advocates the evaluation of the range of competencies, skills and staffing required at the central, county and district levels, for efficient IVM implementation, including needs for effectively overseeing rapid national scale-up of major interventions. As vector control is scaled up, it will be important to clarify core functions at the various levels of administration (national, regional, counties/districts) (Table 2). Table 2 shows that a wide range of competencies and skills is required for effective vector control. The NMCP will therefore coordinate with relevant sector partners to assure a broad range of competencies and infrastructure that complements decentralized decision-making (in line with overall national decentralization policies) and which places vector control decisions appropriately closer to the affected/targeted communities.

At the Central Level, the capacity of the Vector Control Unit of the NMCP/MOH&SW will be progressively strengthened to manage IRS operations, as part of a wider capacity strengthening on IVM. Opportunities for advanced education and in-service training will be aggressively pursued to establish a full complement of critical skillset in entomology, epidemiology, logistics management, general vector control, data management, as well as program monitoring and evaluation. Such training opportunities will involve research focusing on addressing priority issues on vector control in Liberia. The government will aggressively pursue opportunities to also enhance the competencies/capacities of relevant MOH&SW divisions such as Environmental and Occupational Health, as well as other primary stakeholder sectors such as Environmental Protection Agency (EPA) to consolidate national preparedness.

Table 2: Core Functions at different Administrative levels of National Vector Control

Central Level	
<ul style="list-style-type: none"> • Strategic direction to programs • policy development • Standard settings, norms and M&E indicators • Programme funding/resource mobilization • Prioritize and allocate financial resources • Epidemiologic analysis • Quality assurance • Training and support for district/sector programs and vector control 	<ul style="list-style-type: none"> • Coordination of emergency response • Evaluation & validation of operational research • Decision-making and planning of region programs/activities • Determine human resource needs • Overall program monitoring • Monitor and evaluate Country/District IRS implementation • Supply chain management
County and district levels	
<ul style="list-style-type: none"> • Local planning of implementation • Resource prioritization and allocation • Disease surveillance • Programme monitoring • Health education 	<ul style="list-style-type: none"> • Train field staff/village health volunteers • Undertake vector control activities, assist in operational research • M&E: collection and initial collation of local data on various vector control aspects

Staffing and relevant competencies at the regions, counties and districts (e.g. community health and social welfare teams) will be consolidated with a medium- term goal of decentralizing core functions. Dedicated vector control coordinators will be established within the regions and counties, as part of the local health management teams, to enhance the coordination of malaria control activities within their areas of assignment and facilitate coordination with the NMCP at the central level. National capacity for correct quantification of procurement needs (insecticides, spray equipment, and spray team sizes, based on housing and population data) is critical to the success and timeliness of spray operations. Quantification is best done from the counties and accumulated up the chain to the central level. Hence training on standardized methodologies for IRS needs quantification will be instituted as part of overarching IRS training efforts to build such local capacities within the targeted counties/district. This should be done with a view of integrating into the overall supply chain capacity within the counties and districts.

A critical mass of trained entomology field technicians will be created in the counties to support A full range of monitoring activities at sentinel sites and a central insectary and entomology laboratory will be established to support vector control operations (refer subsequent section on Entomology).

IRS also requires a broad range of temporary field staff during spray operations (spray operators, store keepers, community mobilizers etc.). These categories of workers usually are best selected from the targeted counties and districts, and will require short, but standardized and tailored, training immediately prior to each spray season to ensure that spray operations are efficiently conducted, assuring spray operator quality (crucial to the protection of sprayed households from malaria) and maximal protection of human health and environment from needless insecticide exposure. The training of temporary/seasonal field workers will be decentralized, as IRS operations is scale up across the country – denoting that Master trainers will be established in each of the targeted counties, to conduct the required standardized training. Collaboration between the NMCP and the Ministry of Internal Affairs will be enhanced to further facilitate the identification of temporary field workers.

Box 2: Some Categories of Temporary IRS Field Workers

Procurement/logistics officers
Spray operators/supervisors
Environmental compliance technicians
IEC/BCC workers
Warehouse keepers
Washers and disposal technicians
Data clerks
Drivers

Insecticide poisoning management training will be provided to health workers at selected health facilities, which will also be equipped to serve as reference points for insecticide poisoning. These facilities will be appropriately equipped to manage poison incidents.

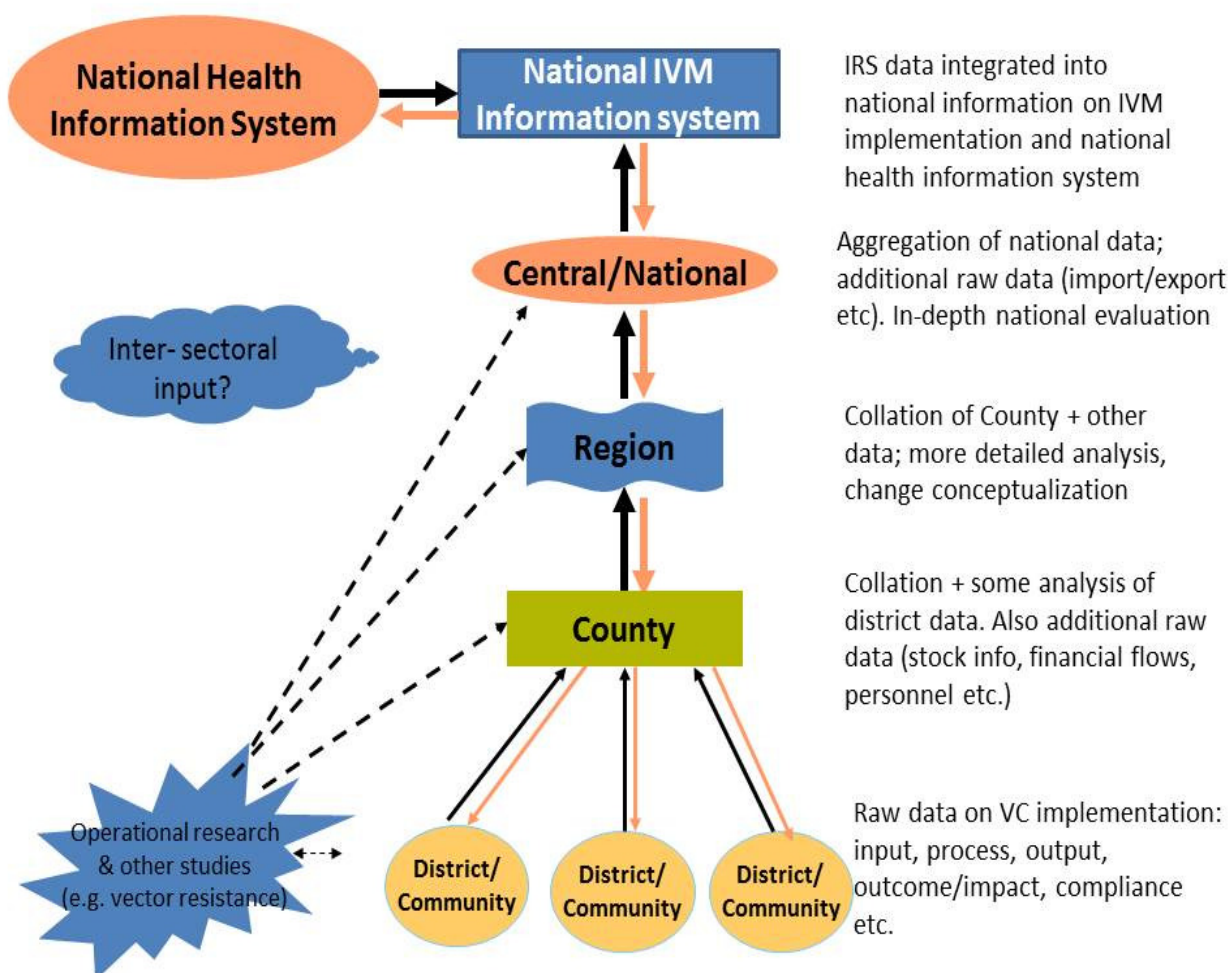
3.4b Information management for IRS

Timely flow of information between all levels of IRS operations/program administration (central, regional, and country levels) is critical to ensuring a sound basis for the deployment of the intervention. It will also enable correct assessment of the impact of the IRS operations and the

timely resolution of any potential setbacks in the delivery of the intervention or changes in disease eco-epidemiology, either due to natural ecological reasons or brought about by the IRS operation. An integrated information system on IVM will be established and composed of the following characteristics (data evaluation and reporting will target the various constituencies also outlined under the section on “Advocacy and communication”):

- i. Appropriate and adequate technical and infrastructural capacities will be established at all levels for timely collection, management and utilization of data on the local malaria vectors, eco-epidemiology and burden of diseases, as well as progress in the IRS implementation - including outcomes and impacts. Indicators or data sets to be measured/ collected will be identified and the frequency of those measurements clarified, documented and disseminated to all relevant staff to ensure comparability of data sets. This will include input, process, output, outcome and impact indicators (e.g. insecticide quantities used, eligible structures sprayed, households receiving IEC/BCC services, persons receiving training- by category of work; IRS household refusal rate, entomology indicators as outlined in Table 3, malaria incidence in sprayed houses compared to unsprayed, planning meetings held, compliance rates on environmental and human health safeguards). Quality control measures will be established to protect the integrity of data from the points of collection/measurement up through to the point of interpretation and utilization.
- ii. There will be a standardized scheme for regular communication/ dissemination of level-appropriate information to facilitate timely decisions to improve the outcome of IRS operations. The NMCP will establish a proactive policy review mechanism (preferably under the MSC mechanism) to promote principled utilization of gathered scientific data in order to effectively manage the expectation of policy makers and politically oriented concerns of the public and inform ongoing review of policy implementation and impacts.

Fig 1: Routes for vector control data collection/management



3.5 Evidence-Based Decisions Making

The government of Liberia will build the infrastructure and an integrated system including relevant human resources to adequately plan, implement, and conduct entomological and epidemiological monitoring to enable ongoing improvement in the targeting of IRS operations and to maximize the overall impact on disease burden.

3.5a Entomology Monitoring

Entomological capacity will be established with the following components:

- i. *Functional infrastructure* (e.g. equipped insectary and associated entomological laboratory, sentinel sites). A central insectary and associated entomology laboratory is being established at LIBR to undertake a full range of evaluations in support of malaria vector control. The insectary will support the coordination of assessments by sentinel field stations (ref: Table 2)
- ii. *Trained human resources* (include central managerial level, as well as trained entomology field technicians and laboratory technicians). Designated insectary and laboratory staff and NMCP entomology focal points have already undergone critical training and will continue to receive relevant additional training and mentoring to enable vigorous initiation of required evaluations.
- iii. *Vector surveillance and monitoring regime*, with clearly defined indicators and standardized protocols. Entomology sentinel sites will be established within the counties and manned by trained entomology technicians (ref: Table 2). These sites will form a national network to capture relevant data on the major eco-epidemiological settings of malaria transmission in the country. A national scheme on entomology surveillance and monitoring will be established to track local vectors and evaluate impact of ongoing vector control interventions on malaria transmission.
- iv. *Efficient data management and utilization capacity* (refer preceding section on “information system”).

Recognizing that foci of resistance/reduced susceptibility to DDT and other pyrethroids exist in some local malaria vector populations in the West African region, the development of relevant entomological monitoring systems to enable effective management of insecticide resistance will be a top-most priority. The LIBR will, through a formal MOU with NMCP (ref 2c) assist with surveillance and monitoring and conduct critical operational research to clarify/fill existing information gaps (Table 3). Institutional arrangements and roles will be clearly outlined and supported to ensure ongoing and integrated support to malaria vector control implementation by the NMCP.

Table 2: Basics on Entomology Sentinel System

- A national entomology sentinel system will be established and linked to the central insectary and entomology laboratory that will be sited at the LIBR.
- The number and location of the sentinel sites will be guided by subsequently developed and periodically updated criteria, ensuring coverage of (a) major ecotypes in the country, (c) potentially isolated vector populations due to geographical barriers (b) areas with known reduced insecticide tolerance or resistance
- The sentinel sites will conduct ongoing monitoring and surveillance (ref: Table 3) on local malaria vector populations in defined geographical locations, using standardized and internationally recognized methodologies/protocols.
- Other ecological/environmental factors with direct impact on the vector populations (e.g. rainfall, temperature) will also be recorded.
- The generated data will provide insight on vector ecology, vector population structure and distribution and spatial and temporary changes in species, disease transmission related behavior (biting and resting preferences); efficacy and effectiveness of vector control intervention employed to control malaria
- Sentinel sites will be manned by entomology field technicians (2 and a Supervising technician) who would have received formal training and attained proficiency on all the required methodologies and assessments to be conducted at the site. The technicians will be literate (with previous technical or secondary education) and able to document data, read and understand simple instructions in the official national lingua franca.
- The sentinel sites will have basic equipment and supplies to conduct its assessments, including microscopes, insect cages, dissecting kits etc.
- The technicians will be guided by detailed and user-friendly sentinel site (field) manuals. As needed, they will mobilize and train persons in nearby communities to provide temporary support to field assessments as may be described in the sentinel site manuals.

Table 3: Desirable entomological monitoring indicators

BASIC Entomological evaluations (measured monthly) – Category 1 (sentinel sites):

- i. *Insecticide residual effectiveness (Cone bioassay)* – on major wall surface types (Mud, cement – painted or unpainted, and wood) in the localities where indoor residual activity is conducted and on LLINs. Provides rate of decay of the insecticide determined for (a) IRS by 24 hour mortality of mosquitoes exposed to sprayed walls for 30 minutes and (b) for LLIN as 24 hour mortality of mosquitoes exposed to LLINs for 3 minutes.
- ii. *Night catches (indoor & outdoor)* - provides insight into biting behaviour of local vectors
- iii. *Pyrethrum spray catches* – Done between 6am and 8am at pre-selected houses. Indicator provides insight into vector entry into sprayed rooms over time. Compared with unsprayed homes and other higher category 2 evaluations on the catches (e.g. parity, sporogony, and blood meal analysis) provides insight on effectiveness of intervention and indicate transmission risk changes in sprayed rooms.
- iv. *Species identification (morphological) and composition* - from monthly catches listed above. It will enable mapping of vector distribution and tracking of any changes in species composition within the year
- v. Vector susceptibility evaluation (CDC) bottle assay- 2x/year for WHOPES approved insecticides

Entomological evaluations - Category 2 (Insectary/Entomology laboratory at LIBR)

The Category 2 evaluations require advance training and access to relevant ELISA and PCR equipment.

The following indicators will be assessed:

- i. Sporozoite rates (quarterly) - provides insight into risk of getting malaria
- ii. Entomological inoculation rates (quarterly) – measure risk of getting malaria through infected bite
- iii. Blood meal analysis (half yearly) – provides insight into feeding preference of mosquito vector
- iv. Parity evaluations (quarterly) – especially from room catches denotes the effective intervention is in killing off vectors
- v. Resistance mechanism (annually)

3.5b Epidemiological Monitoring

To effectively target and monitor the impact of IRS operations, additional information over and above that normally provided via periodic cross-sectional population-based surveys, such as the Malaria Indicator Survey or the Demographic Health Survey will be required, as these usually do not provide the scale and detail of information required. Country capacity will be further strengthened to collate and utilize routine facility-based, parasitologically confirmed monthly incidence data to provide ongoing data and detailed mapping of disease prevalence. When effectively considered in the light of entomological and other parameters, it will enable progressive refinement of the targeting of IRS and improve overall cost-effectiveness. The NMCP will continue to update the mapping of malaria prevalence to inform ongoing refinement of IRS targeting.

3.5c Operational and outcome indicators

Clearly defined indicators that are critical for evaluating the efficiency of IRS operations will be measured to provide basis for sound decisions. These include input indicators (e.g. insecticide quantities used, amount of personal protection equipment utilized, spray pumps utilized, labour inputs/cost), output indicators (e.g. percentage of eligible structures sprayed as a function of the total structures identified/counted in the target area, percentage households receiving IEC/BCC services, numbers of IRS workers receiving training by work category) and outcome indicators (e.g. population covered by spray operations (total, by gender, and by preferred age/groupings such as children under five years of age and pregnant mothers), , and spray refusal rate among targeted households).

Evaluation of the cost-effectiveness and efficiency of the IRS intervention – providing opportunity for comparing with other vector control interventions options—will require clarified indicators such as the cost per persons protected, where all cost categories are identified, standardized and quantified.

3.5d Insecticide Selection for IRS

Entomology capacity is particularly relevant to the selection of insecticides for IRS. The selection of IRS insecticide will fully consider the following factors:

- Selected insecticides must be recommended by WHOPES for IRS. All selected insecticides for IRS must be duly registered for that purpose in the country. Where such insecticides are not registered, the full national requirement for registration will be fulfilled prior to its importation, except where temporary exemption under emergency conditions is provided by a duly authorized national agency.
- The local vector populations in the IRS target areas must be susceptible to the insecticide formulation selected. This shall be ascertained using standardized WHO or CDC protocols. General WHO guidance for the interpretation of susceptibility rates will be followed. Due regard will be given to pre-existing foci of resistance. Where resistance exists, an insecticide with a different mode of action will be used to better manage the resistant vector strain(s).
- Emergency situations, such as a sudden upsurge of insecticide resistance to available insecticides of choice, may also compel the limited/temporary use of a newer insecticide (particularly of a different mode of action and awaiting full recommendation by WHOPES), as a resistance management tool. In such circumstance the insecticide must, at the very least, have passed rigorous scrutiny of globally recognized reference source such as the Innovative Vector Control Consortium (IVCC).⁷ Utilization of such newer insecticide under special circumstances should be preceded by (i) wide consultation among relevant national experts and as appropriate, international peer references, (ii) professional scrutiny of the performance of the insecticide where it has been tried in other countries of similar eco-epidemiology and transmission profiles, and (iii) confirmed standardized evaluation of the susceptibility of local vector populations to be targeted under the temporary emergency resistance management initiative.

⁷ IVCC is a not-for profit Product Development Partnership aimed at the “accelerated development and delivery of new products and tools that increase the effectiveness and efficiency of the control of insects which transmit disease.” <http://www.ivcc.com>

- The length of IRS residual efficacy on sprayed surfaces – This represents the length of protection period the insecticide will provide, when compared against the duration of the local malaria transmission period. Since malaria transmission is almost year-round in Liberia, a longer residual efficacy is desirable. Hence, newer formulations of selected insecticides with longer residual efficacy, or new class(es) of WHOPEs recommended insecticides entering into the market place, should be proactively assessed for suitability
- The cost of insecticide compared to other insecticide alternatives for IRS , with due consideration to other criteria such as length of residual efficacy, choice limitations imposed by existing vector resistance, as well as peculiar operational cost associated a particular insecticide. It is recognized that significant tolerances to pyrethroids exist in certain areas, imposing the use of carbamates.

3.5e Management of Vector Resistance to IRS Insecticides

The development of insecticide resistance in the local vector(s) of malaria is a major area of concern for any insecticide based intervention, as it will directly threaten the continued viability of the insecticide. Pre-existing foci of Kdr resistance allele for DDT and pyrethroids have been confirmed for many locations in the West Africa region. Additionally, recent evaluations under ongoing IRS operations have also shown significant reduction in vector susceptibility to some pyrethroids in certain locales. Thus, the establishment of a robust management scheme to prevent/control the development of insecticide resistance is a primary consideration for IRS operations in Liberia.

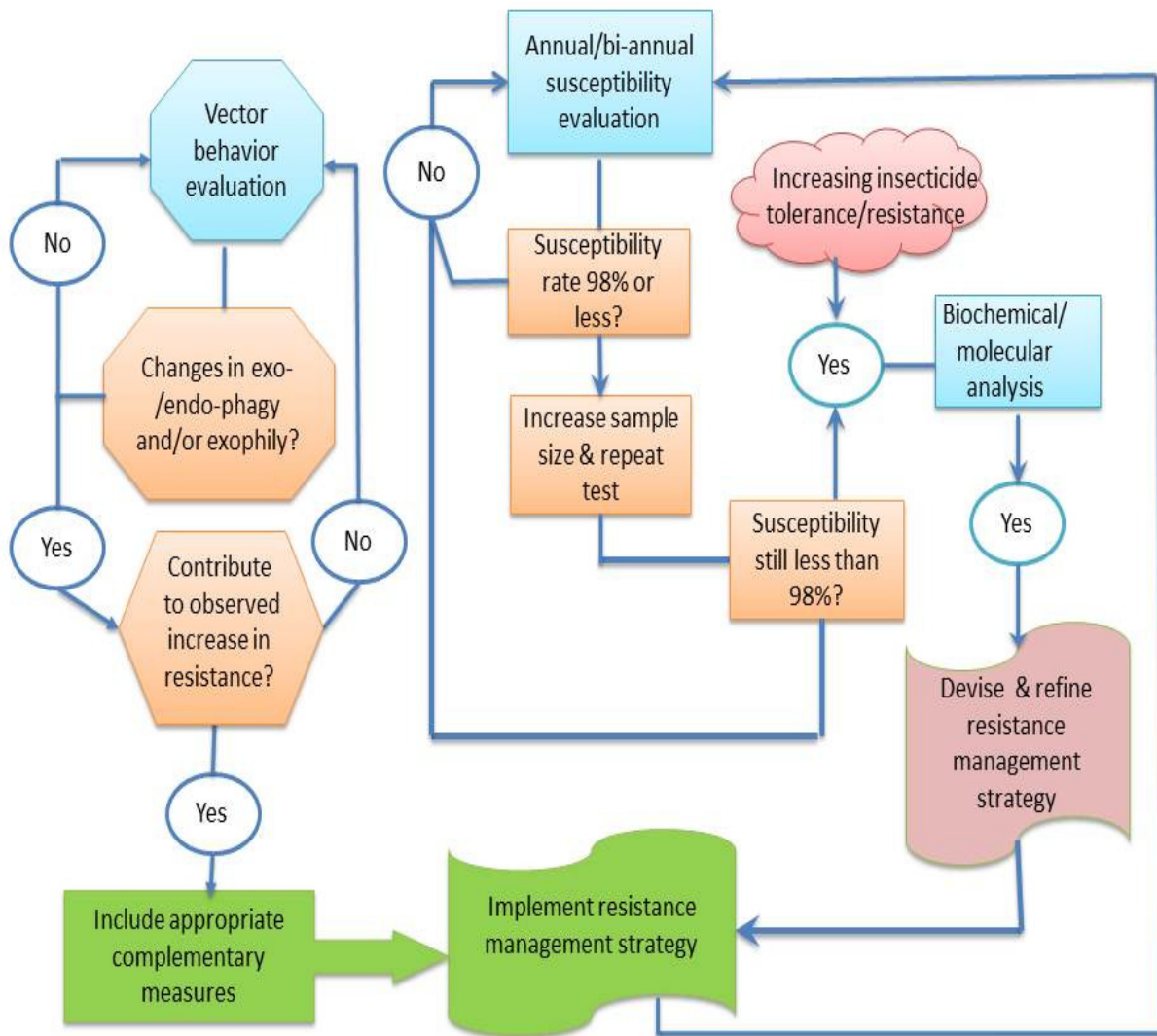
NMCP will work with relevant research institutions to determine the levels, types and distribution of resistance alleles/mechanisms in the mosquito populations in Liberia to help shape a resistance management scheme in the shortest possible time. A potential resistance monitoring and management regime is proposed to be established in Liberia (Fig 2), which should have the following component:

- a. The previously discussed entomology sentinel system will ensure representative sampling of the major ecological settings within IRS targeted areas.

- b. The susceptibility of the vector populations at the sentinel sites to WHOPEs recommended insecticides for IRS will be measured, to establish a baseline distribution. This will be followed by twice annual evaluation of vector susceptibility. A determination of susceptibility rate of 95% or less will trigger annual biochemical/molecular evaluation of resistance mechanisms [Knock down resistance (Kdr), Glutathione S-Transferase (GSTs), Cytochrome P450s, Esterases, Acetylcholinesterase (AChE) or Modified Acetyl Cholinesterase (MACE), and Gamma-Amino Butyric acid (GABA)], using either TaqMan Plasmodium Assay or Polymerase Chain Reaction (PCR).

The above evaluation of Resistance mechanisms will provide in-depth understanding of the local diversity of the observed and assist the selection of insecticide with a different mode of action to help manage the development of the resistant strain(s) of mosquitoes and also determine the strategic approaches in terms of the timing/sequencing and/or geographical distribution in the use of the insecticides (e.g. rotation, mosaic). Where initial baseline assessment indicates pre-existing tolerance to insecticides, a six-monthly susceptibility test will be established to guide. Vector susceptibility/resistance data will be fed into the WHO moderated regional database on insecticide resistance, to assist region-wide strategies to manage insecticide resistance.

Fig. 2. Potential resistance monitoring and management scheme



4. SELECTION OF IRS TARGET AREAS

Consistent with the stated goals of the National Malaria Strategic Plan to halve malaria morbidity and mortality, IRS is anticipated to expand with time. The expansion will be incremental, follow strict criteria and build on successes and lessons gained from ongoing operations. Current IRS operations cover five counties (14 districts) in two regions (ref: Table 1).

Table 1: IRS counties and districts in Liberia (2011)

Region	Counties	Districts
South Central	Grand Bassa	Common wealth; District 1, 2,3 & 4; Nekreen, Owen's Grove
	Margibi	Firestone & Mamba Kaba
	Montserrado	Careysburg
	Bong	Kokoya & Kpaai
Nimba	Nimba	AML Concession Area

The following considerations, among others, will inform the selection of IRS target areas:

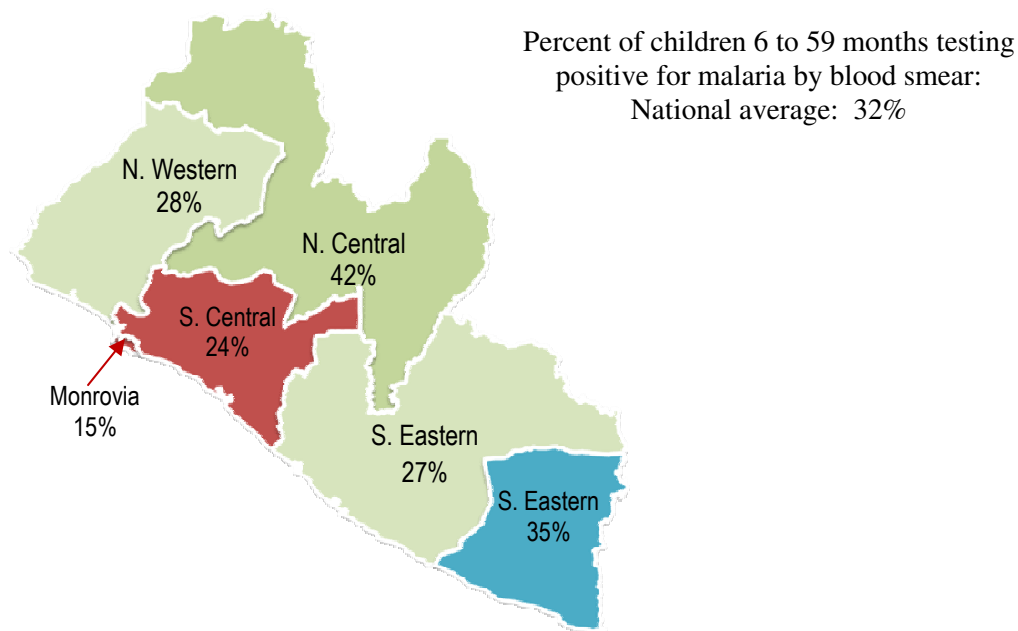
- i. *Areas with highest malaria burden* - Rural communities in Liberia have been shown to generally have higher parasitemia loads among children, compared to urban communities.
- ii. *Under-served areas, in terms of access to health services* –The strategic approach will be to prioritize and enhance disease prevention interventions in these areas.
- iii. *Ease of physical access* - IRS requires extensive logistics and movement of spray teams; remote areas with comparatively difficult access may increase the operational cost. The decision will focus on comparative cost and these areas may best be served with a robust LLIN intervention scheme that emphasizes maximal utilization. In all cases cost comparison and sustainability consideration will inform final decisions.

A two-phased strategic approach is envisaged in the use of IRS to control local malaria transmission.

- a. Phase 1 of the strategic approach will involve deploying in areas of highest malaria burdens where IRS will have the highest potential impact, to quickly ‘crush’ transmission and force lower transmission equilibrium – creating increased prospects for further reductions, as the utilization of LLIN, under the ongoing universal coverage strategy, takes hold. Based on the results of the 2009 National Malaria Indicator Survey (Fig 3), this initially include the North Central Region (Lofa, Bong, Nimba and Gbarpolou counties), with an overall malaria average of 42%.
- b. The geographic spread of Phase 2 of the scale up of the IRS will depend on the existing coverage of LLINs and prevalence. It is anticipated that the Liberia would have developed the capacity to extend and successfully deploy IRS operations to the more distal South Eastern Region, should prevalence levels continued to be high, or that given maximal utilization of LLINs in those areas, the addition of IRS will be required to achieve even lower transmission or final elimination.

It is noted that IRS has a role, and is effective in all levels of malaria endemicity - from very intense to hypo endemicity. The strategy for deployment however, changes from broad application to surveillance-driven focal spraying as endemicity is reduced down through meso-endemicity, hypo-endemicity and local elimination and the objective of control efforts progress increasingly to mopping up of residual transmission (transmission hotspots). The phased approach to scaling up IRS in Liberia is therefore mostly based on the reality that it may not be feasible to simultaneously deploy IRS across all 50% of the country (or 85% of households), as stated in the National Malaria Strategic Plan (2012 – 2013). Areas will have to be phased in and available resources will need to be applied judiciously and in a way that elicits the most impact on local burdens. The ‘second phase’ of scaling up IRS implementation therefore anticipates further extension of the current spray operations from parts of Monrovia, South Central and North Central Regions into more distant areas of the country, as (a) experiences are consolidated, (b) national capacities built up, and (c) resources mobilized to sustain cost-effective scale up to achieve national targets.

Fig 3: Prevalence of Malaria in Children in Liberia by Region (NMCP 2011)



4.1 Timing of IRS in Liberia

Typically, malaria transmission in Liberia is year round, with peaks between June and October, with the onset of rain in May/June. The period between November and April is usually mostly dry. IRS operations involve significant transportation of people, supplies (insecticides, and equipment (spray pumps and accessories), as well as a need for households to bring out some possessions outside, in order to access walls for spraying. Additionally, it is most desirable that the residual action of the insecticides coincides with peaking of malaria cases – ensuring that the height of killing effect of the insecticide coincide with periods of highest transmission risk. The above factors, denotes that IRS is best conducted in drier season and just before the onset of rains. This usually is between April and May.

5. REFINEMENT OF IRS AND INTEGRATION WITH LLIN DEPLOYMENT

It is recalled that the implementation of the IRS strategic plan will be done within the context of an overarching IVM strategy. The deployment of IRS will therefore be coordinated with that of LLINs to optimize cost-effectiveness and enhance management of insecticide management and transitions in co-deployment of the two interventions in the long-term. Co-deployment strategies become especially important as local transmission is successfully reduced and pre-elimination conditions are achieved in certain geographical areas. Such decisions will however be informed by very robust and integrated disease surveillance system and draw upon relevant recommendations and guidance of WHO.

There is currently no standardized methodology for determining the circumstances under which a combination of the two interventions (or what levels of combination) will have the maximal benefits, or the extent of any such benefit. As a general principle, however, WHO currently recommends⁸ combining IRS and LLN when a single intervention cannot completely cover all of the populations at risk, or achieve the maximal disruption of transmission possible. For Liberia, the current priority, which may not change for a while – will be to assure full and universal coverage of all population at risk of malaria with IRS and/or LLINs. For Liberia where malaria is mostly endemic and all of the population is at risk, the strategy, in the short to medium term, will be to use IRS to accelerate reductions in local transmission and disease burdens. LLIN will continue to be phased with the aim of achieving maximal utilization rates. As pre-elimination conditions are achieved in local/geographic areas, an elaborate and surveillance driven strategy will be ushered in to consolidate gains, as summarized in the following section.

⁸ WHO (2010). *WHO Technical Consultations on combining Indoor Residual Spraying and long lasting insecticidal net intervention*. World Health Organization, Geneva Switzerland. 20 p.

6. WASTE MANAGEMENT

Effective management and sound disposal of waste is a primary consideration in the successful implementation of any IRS intervention. There are two categories of waste for which the following:

- **Insecticide contaminated liquid waste (from washing and rinsing activities linked to IRS).** Two major actions will be taken to minimize effluent generation and reduce environmental contamination.
 - A progressive triple rinse-water reuse: Spray pumps will be rinsed out via a series of barrels at the end of each workday spray activities. The rinse-water will be reused for the following day by filing the first round of each operators pump. The washouts from the last day of the spray campaign will be decanted into the soak pit. A policy of “minimum release of water into the environment” will be strictly enforced
 - Use of Soak pits and prevention of washouts into drains: Wash water from daily cleaning of spray operator PPE (e.g. coveralls), will be decanted into a soak pit, built to standard specifications - to trap the pesticides long enough to ensure denaturing within the soak pit. No wash water will be released into the general environment. The soak pits will be sited away from streams or underground water.
- **Insecticide contaminated solid waste.** This includes discarded gloves, mouth guards, empty insecticide sachets and paper carton materials. There will be strict inventory to ensure that all solid waste get retrieved from point where they are generated , secure-stored and transported under supervision, to designated disposal locations. Solid waste from IRS operations will be disposed in high temperature incinerators that meet relevant WHO-FAO recommendations/ standards for environmentally sound incineration of

insecticides.⁹ To meet the demand of a scaled-up IRS implementation, national capacity to dispose insecticide contaminated waste there will be increased with the installation of incinerators that meet relevant FAO and WHO specifications.

7. RESOURCE MOBILIZATION

A detailed, multi-year and fully-costed national IRS work plan will be developed, based on this strategic plan. It will be an integral part of a costed and overarching IVM work plan, which anticipates the deployment of LLINs, as well as other complementary vector control interventions. Efforts will concentrate on mobilizing dedicated financial resources from increasingly diversified sources¹⁰, for cost-effective implementation and expansion of IRS. The IRS work plan will detail and cost all aspects of planning, managing, deployment and monitoring and evaluation, including staffing at the various levels (both long term and temporary field workers), community mobilization, forecasted procurement, storage and transportation, disposal, and data collection/management.

The IRS strategy and work plan will form the basis for structuring an aggressive resource mobilization efforts – as it will enable forward planning by government on the allocation of in-country resources and facilitate targeted submissions to the country’s developmental partners, such as The Global Fund for malaria, HIV/AIDs and TB, World Bank, African Development Bank, and the Private Sector.

⁹ WHO (2007). *WHO-UNEP Manual on Sound Management of Pesticides and Diagnosis and Treatment of Pesticide Poisoning: A Resource Tool*. World Health Organization, Geneva. 332 Pages. (Document also accessible at. www.who.int/ipcs/en/a)

¹⁰ Current IRS funding comes from a single source (PMI). Funding sources will need to be diversified and scaled up to match anticipated increase in cost to expand IRS.

7.1 Encouraging Private Sector Investment

The potential of malaria to raise the cost of labor through disease-related absenteeism and reduced worker output is a significant threat to the profitability of private sector investments. Private sector investment in workplace and community-based programs in malaria prevention programs has been demonstrated to reverse the adverse impact of malaria on business operations. Opportunities for private sector input and public-private-partnerships (PPPs) exist in Liberia (refer to section on cross-sectoral collaboration). This will be fully explored to build on the existing excellent relationship between the NMCP and a number of the agriculture and mining sectors. Modalities and incentives will be established to facilitate private sector investment in ‘corporate social responsibility’ vector control initiatives, including IRS operations.

ANNEX 1: MAJOR FOLLOW UP ACTIVITIES

The following are some of the proposed follow up actions to the National Strategy on IRS.

Major Activity	Timeline
Formal approval/adoption of the National IRS Strategy	July
Development of a 4-year budgeted work plan on IRS based on the National IRS Strategy	September 2012
National IVM strategy to provide overarching framework for vector control <ul style="list-style-type: none"> • Development of a National IVM Strategy 	July 2012
Initiate fund mobilization based on work plans based on the work plans, including: <ul style="list-style-type: none"> • Funding Proposal on IRS to GFATM and other sources • Elaborate opportunities/options for private sector investments/involvement in malaria vector control 	Ongoing September 2012
Entomology	
<ul style="list-style-type: none"> • Fully functional insectary and entomology laboratory, including PCR lab, at LIBR 	August 2012
<ul style="list-style-type: none"> • Refresher training for laboratory & insectary technicians 	September 2012
<ul style="list-style-type: none"> • Establish and equip entomology sentinel sites; finalized national entomology surveillance protocols, data management schemes and field technician manuals 	October 2012
National Insecticide Resistance Management Strategy <ul style="list-style-type: none"> • Comprehensive entomological baseline to (a) identify distribution of malaria vectors, and (b) status and distribution of susceptibility/resistance • Develop a resistance management strategy • Initiate implementation of resistance management strategy 	Dec-Jan 2013 Feb 2013 Feb 2013
Pesticide Management	
<ul style="list-style-type: none"> • Comprehensive review of national public health insecticides management scheme, including environmental health safety and disposal within national IRS scale up 	Dec-Jan 2013
<ul style="list-style-type: none"> • Assessment of incineration requirement for scaled up coverage target and establishment of incinerator(s) compliant 	Dec 2012

ANNEX 2: ENVIRONMENTAL & HUMAN HEALTH SAFEGUARDS IN IRS

RISKS RELATING TO PESTICIDE LIFE CYCLE	MITIGATION MEASURES
Procurement	
Procurement from uncertified sources	<ul style="list-style-type: none"> • Good registration process requiring submission of insecticide specification, source of supply etc.
	<ul style="list-style-type: none"> • Designation and licensing local importer, linked to a known single international supplier
	<ul style="list-style-type: none"> • Establishment of a transparent tendering process
Importing wrong pesticide specification	Above-listed mitigations plus <ul style="list-style-type: none"> • Robust inspection at port of entry and manufacture specification
Pilferage at port-of-entry and enroute to central storage	<ul style="list-style-type: none"> • Linking transportation from port-of-entry to central warehouse as part of importer responsibility
	<ul style="list-style-type: none"> • Use of certified/licensed drivers and dedicated transportation.
	<ul style="list-style-type: none"> • Use security guard during transportation
Pilferage at central stores	<ul style="list-style-type: none"> • Pesticide stock protected by same high level security for drugs and other essentials
Inland transportation	
Inadequate transportation	<ul style="list-style-type: none"> • Use of certified/licensed drivers and dedicated vehicles.
Pilferage	<ul style="list-style-type: none"> • Use security guard during transportation
Transport relation incidents	<ul style="list-style-type: none"> • Transporters trained on first response to incidents (e.g. secure site, call emergency response)
Storage and pesticide management in districts/ sub-districts	
Pilferage	<ul style="list-style-type: none"> • Secure, dedicated storage facilities and, as necessary, use of security guard
	<ul style="list-style-type: none"> • Strict auditing scheme (e.g. daily spray cards, team leader daily summary cards, supervisor daily summary cards)
	<ul style="list-style-type: none"> • Regular inventories
Inappropriate storage practices	<ul style="list-style-type: none"> • Trained storekeepers in pesticide management
	<ul style="list-style-type: none"> • Regular inspections
	<ul style="list-style-type: none"> • Good storage maintenance
	<ul style="list-style-type: none"> • Effective inspection regimes

Annex 1 [cont'd]

RISKS RELATING TO PESTICIDE LIFE CYCLE	MITIGATION MEASURE
End-use of pesticide: Human safety	
Exposure of spray operators and other handlers	▪ Training on best practices for all categories of workers
	▪ Use of full PPEs by spray operators
	▪ Availability and effective use of ablution facilities
	▪ Clear criteria for reprimand for non-compliance
Exposure of households	▪ IEC implementation to enhance household safety and compliance (1-hr wait time before re-entry etc.)
	▪ Field supervision to assure best operator practices
	▪ Avenue for receipt of household complaints
	▪ Effective inspection regimes
Poisoning incidents	▪ Staff training and IEC with components aimed at preventing poisoning.
	▪ Enhance capacity for poison management by: <ul style="list-style-type: none"> ○ Training of all category of workers to identify danger signs and required response ○ Training health workers, designate & equip district reference points for treatment of incidents of pesticide poisoning
End-use of pesticides: Environmental Safety	
Environmental release from handling/spray activities	▪ Best practices (triple wash/rinse water re-use)
	▪ Use of pits
	▪ Prohibition of decanting into streams and open drains
	▪ Prohibit worker washing in streams
	▪ Clear criteria for reprimand for non-compliance by IRS workers
	▪ Effective inspection regimes
Non-recommended use of pesticides	▪ Secure storage, management and inventory system
	▪ Effective enforcement
	▪ Significant punitive measures against pilferage
	▪ Effective IEC on dangers and consequences of non-recommended use of pesticides
	▪ Effective coordination between MOH/NMCP, MOA, EPA and Agric-based NGOs (including farmer groups)
Release of empty sachets/packaging in general environment or reused for non-recommended purposes	▪ Strict auditing (see above) and accounting for empty sachet and packaging materials for sound disposal

